TRUCK FOR SKATEBOARDS

FIELD OF THE INVENTION

The present invention is directed to an improved truck for a skateboard, all-terrain board or scooter, and more particularly to a truck having two independently spring-loaded pivoting members.

BACKGROUND OF THE INVENTION

Conventional skateboards utilize steering mechanisms known as trucks. Typically a truck is mounted near each end of the skateboard, and include a pair of wheels at each end of their axles. The trucks provide some steering response, whereby when a skaterboarder shifts weight laterally across the board the axle twists, causing the board to turn. The trucks also serve, by means of a suspension system, commonly urethane bushings, to resiliently resist the skater's lateral tilt of the deck, thus stabilizing the board, and returning it to its normal position when the turn is completed. This lateral stability is crucial for both distance riding and aerial tricks where a firm platform is desired. Current trucks must sacrifice their ability to turn for lateral stability, thus becoming stiff and unresponsive when tightened sufficiently. Conversely, loosening the trucks so the board can turn easily makes it dangerously wobbly, especially at higher speeds. Furthermore, even in optimal conditions, the rate of turn provided by conventional trucks is very little.

Previous attempts have been made to design a truck with increased maneuverability. One method utilizes a truck having a trailing castor that provides the skateboard with a second axis of rotation is described in U.S. Patent No. 5,522,620 to Pracas.

In this prior art device, the truck comprises a conventional truck mounted to a pivotal member. The pivotal member is coupled to the nose of the deck about a bearing member which rotates

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along a plane parallel to the direction of motion. A pair of stop members are shown that limit the pivotal movement between two extreme positions. Further, a locking member may be engaged to stop any rotation, thus returning the truck to a conventional configuration.

Although the '620 device provides a second pivot, the lateral plane of pivotal rotation merely provides the front of the skateboard with a side to side movement. Because the axis of rotation is parallel to the direction of motion, lateral weight shifting does not bear any leverage upon the pivotal member when the arm is near the center of its range. Further when the pivotal member rotates towards its extreme positions, the skaters' lateral weight imposes exponentially more leverage upon the member causing overturning and loss of control. Additionally, the '620 device does not regulate the torsional movement of the trailing castor. A strong bias to center is desired when performing aerial tricks so as to provide a predictable and stable landing. Further, regulating the rotational movement by a spring system is also important to stabilize the truck at higher speeds.

Accordingly, a need exists for an improved truck that provides the user with more control over the torsional movement of the pivoting member and being adjustable for users of varying needs.

SUMMARY OF THE INVENTION

The present invention provides an improved skateboard truck which pivots about two axes and provides a combination of adjustable lateral stability and enhanced turning abilities. Generally speaking, a truck according to this invention comprises an axle having a pair of wheels mounted at opposite ends thereof. A shaft extends through the center of the axle and is secured thereto on the side of the axle distal from the point of securing

the truck to a skateboard. The truck further includes a resilient bushing circumferentially mounted on the shaft on the side of the axle proximal to the point of securing the truck to the skateboard for providing a first pivot axis about the axle, and a swivel connected to the axle and adapted to be pivotally attached to the underside of the skateboard about a second pivot axis. The swivel and the bushing are ganged together to provide pivoting of a skateboard in two dimensions.

In a presently preferred embodiment of the invention the skateboard truck includes a base attachable to the underside of a skateboard and an arm carried by the base and rotatable relative to the base about a first axis. An axle having a pair of wheels mounted at opposite ends thereof is carried by the arm and the axle is rotatable relative to the arm about a second axis. A spring-loaded linkage is operatively connected between the base and the arm for limiting the rotational motion of the arm and biasing the arm towards a rest position aligned with the skateboard's direction of movement.

The improved skateboard truck is preferably attached to the front of the skateboard, while a conventional truck is fastened to the rear. Because of the improved capabilities of the present invention the skateboarder is able to propel the skateboard by shifting the nose of the skateboard from side-to-side. Further, the present invention enables the rider to smoothly navigate the front of the skateboard to-and-fro and complete sharp turns at a rider controlled rate. As such, the skateboard closely simulates the dynamics of a surfboard on the water.

DESCRIPTION OF THE DRAWINGS

These and other features and advantages of the present invention will be better understood by reference to the following detailed description when considered in conjunction with the accompanying drawings wherein:

Figure 1 is an exploded perspective view of the skateboard truck of the present invention;

Figure 2 is a cross-sectional side view of the base plate of the truck in Figure 1;

Figure 3 is a bottom view of the base plate in Figure 2;

Figure 4 is a cross-sectional side view of the pivot member of the truck in Figure 1;

Figure 5 is a cross-sectional side view of the assembled truck in Figure 1;

Figure 6A is a top view of the truck in Figure 1 mounted onto a skateboard, the view showing the arcing lateral movement of the nose of the skateboard as it moves to-and fro;

Figures 6B and 6C are perspective views of the of the truck in Figure 1 mounted onto a skateboard, the view showing the arcing lateral movement of the nose of the skateboard as it moves to-and fro;

Figures 7A and 7B are simplified schematic views of the path of motion of a conventional skateboards;

Figures 7C and 7D are simplified schematic views of the path of motion of the skateboard in Figure 6; and

Figure 8 is a side view of an alternative embodiment of the truck in Figure 1.

DETAILED DESCRIPTION OF THE INVENTION

In a preferred embodiment of the invention, there is provided a skateboard truck **10** having two independently spring-loaded pivoting members. As shown in Figure 1, the truck **10** comprises a baseplate **12**, a pivoting member **14**, and a hanger **16.**

Referring to Figure 1, the baseplate **12** comprises a casting forming a base **20**, a bearing platform **26**, and a housing **44.** The baseplate **12** can be of any suitable construction and made of any suitable material. In a preferred embodiment, the baseplate **12** is cast in A356 prime aircraft grade aluminum and heat treated

to Rockwell T-6. In alternative embodiments the baseplate **12** may be cast or forged of any formable high strength metal or plastic. The base **20** is a substantially rectangular plate having a finite thickness, for example about 3/16 inches, a rear tapered portion **25**, and plurality of apertures **22**. The apertures **22** are suitably configured for mounting the baseplate **12** onto the underside of the skateboard platform.

Referring to Figures 2 and 3, the bearing platform **26** projects upward, and substantially oblique, from the one end of the base **20**. The platform **26** comprises a circular body having a recess **32** formed on its underside by a circular periphery **42** having an inner surface **34**. The recess **32** includes a pair of parallel and spaced apart ribs **40** which extend into the recess **32**. As shown in Figure 2, the bearing platform **26** is defined by an upper surface **27**, which runs parallel to a bearing plane **28**. The bearing plane **28** is defined at an angle oblique to a lateral plane **24** of base **20**, preferably at about 10° to about 25°, more preferably at about 17°. The upper surface **27** comprises a central bore **30**, defining a first axis **36** substantially perpendicular to the bearing plane **28**, and a semicircular notch **38**.

The housing **44** projects upward, and substantially perpendicular from the base **20**, and is integral with the bearing platform **26**. The housing **44** includes a plurality of sidewalls **48**, **52**, **54**, and **56**, and a top wall **49**, forming a cavity **46** in the housing **44** for retaining a spring system, as discussed in detail below. Sidewall **48** comprises a circular opening **58** for receiving a bolt.

Referring to Figure 1, the pivot member **14** comprises a casting forming a cylindrical pedestal **60** having a finite thickness, and an elongated arm **62**. The pivot member **14** can be of any suitable construction and made of any suitable material. In a preferred embodiment, the pivot member **14** is cast in A356

prime aircraft grade aluminum and heat treated to Rockwell T-6. In alternative embodiments the pivot member **14** may be cast or forged of any formable high strength metal or plastic. Referring now to Figure 4, the pedestal **60** includes a circular notch **64** formed about its base portion, and an orifice **66**. A boss portion **70** supporting a link pin **72** extends downwardly from a base portion of the pedestal **60**. Referring back to Figure 1, the arm **62** extends upwardly from the base **60** and comprises a pair of gussets **73** and a cantilevered body **74** having a proximal end **65** and distal end **67**. The gussets **73** are triangular in shape and disposed in parallel along the proximal end **65** of the body **74**. The gussets **73** are integrally formed with the pedestal **60**, forming a void **78** which defines a top surface **63** of the pedestal **60**.

The body **74** is an arching structure extending from the gussets **72** at an acute angle **80** (see Figure 4) relative a lateral pedestal base plane **68**, preferably at about a 17° angle. A lip **83** is formed along the top surface of the body **74**, forming a channel **85** with a bearing surface **87** and a plurality of stiffening ribs **95**, which extend into the channel **85**. Referring to Figure 4, a groove **84** formed in the underside of the body **74** comprises a second series of stiffening ribs **86**, which extend into the groove **84**. The body **74** additionally includes a counterbore **92** defining a second axis **91** inclined at an angle preferably about 63° relative to the pedestal base plane **68**. Referring now to Figure 1, the body **74** further includes a blind hole **88** lined with a urethane cup **90**. Referring back to Figure 4, the blind hole **88** defines a third axis **89** inclined at an angle preferably about 40° relative to the second axis **91**.

With reference to Figure 1, the hanger **16** comprises a casting forming a body portion **100** and end portions **102** extending outwardly from the body portion **100** in opposite directions. The hanger **16** can be of any suitable construction and made of any

suitable material. In a preferred embodiment, the hanger **16** is cast in A356 prime aircraft grade aluminum and heat treated to Rockwell T-6. In alternative embodiments the hanger **16** may be cast or forged of any formable high strength metal or plastic. The end portions **102** include a pair of concave channels on their undersides. Axle rod **104** extending from the end portions **102** carry the skateboard wheels mounted on threaded ends **106.** The hanger **16** further includes a pivot pin **108** extending downwardly from a central region of the body portion **100.** A platform **110** having a cut-out **109** and an eyelet **112,** extends laterally from a central region of the body portion **100,** opposite the pivot pin **108.** As would be recognized by one skilled in the art, the construction of the hanger body can be modified as desired.

Referring to Figures 1 and 5, the hanger **16** is preferably mounted onto the arm **14** by a king pin **114** which passes through the eyelet **112** of the platform **110.** When assembled, the king pin **114** extends through a first bushing **120** disposed between the platform **110** and the arm body **74.** The king pin **114** further extends through a second bushing **122** and a flat washer **118** seated within the cut-out **109,** disposed between a fastening nut **116** and a top surface of the platform **110.** The king pin **114,** nut **116,** and washer **118** can be of any suitable type or construction and made of any suitable material. In a preferred embodiment, the king pin **114,** washer **118** and nut **116** are fabricated from steel having conventional dimensions, preferably about 3/8 inches in diameter. Referring to Figures 1 and 4, in a presently preferred embodiment, the first and second bushings **120** and **122** are urethane. The bolt head **124** of the king pin **114** is displaced on the underside **84** of the body **74,** between the plurality of ribs **86,** such that the king pin **114** does not rotate as the nut **116** engages a threaded portion of the king pin **114.** The pivot pin **108** engages the pivot cup **90** within the aperture **88** to align the hanger **16** relative to the arm **14.**

The compliant properties of the bushings **120** and **122** allows the hanger **16** to pivot about a longitudinal axis **170** (see Figure 5) in conventional fashion, when a sufficient load is applied to an end portion **102** of the hanger **16**. As such, the hanger **16** functions as a first resilient, or spring-loaded pivoting member. As will be recognized by one skilled in the art, the mounting of the hanger **16** to the arm **14** can be modified as desired. For example, a system using a pair of compression springs, as described in U.S. Patent No. 5,263,725 to Gesmer et al., may be used instead of the urethane bushing system.

The pivot member **14** is preferably mounted onto the baseplate **12** is by a pivot bolt **130** which passes through the pedestal orifice **66** of the pivoting member **14**. When assembled, the pivot bolt **130** extends through a nut **134**, a bronze bushing **136**, a pair of bearing plates **138**, a first bearing **140**, and a flat washer **142**. The pivot bolt **130**, nut **134**, and washer **142** can be of any suitable type or construction and made of any suitable material. In a preferred embodiment, the pivot bolt **130**, nut **134**, and washer **142** are fabricated from steel having conventional dimensions, preferably about 3/8 inches in diameter.

The pivoting member **14** is assembled onto the baseplate **12** such that the boss **70** engages the semicircular notch **38**. The washer **142** and the first bearing **140**, which is sandwiched between a pair of bearing plates **138**, are displaced between the pivot bolt head **132** and the pedestal top surface **63**. The first bearing **140** can be of any suitable type or construction and made of any suitable material. In a preferred embodiment, the first bearing **140** is a steel needle thrust bearing having an outer diameter of about 7/8 inches and an inner diameter of about 1/2 inches. The bronze bushing **136** comprises an inner aperture suitable for receiving the pivot bolt **130** and is disposed within the aperture **66** to provide minimum friction between the pivoting member **14** and the pivot bolt **130**. A bearing assembly comprising a second

bearing **146** sandwiched between a pair of bearing washers **144**, is disposed with the circular notch **64** in between the pedestal **60** and the baseplate bearing surface **27**. The nut **134** is disposed within the housing recess **32**, between the pair of ribs **40**, such that the nut **134** is confined and can not rotate as the nut **134** engages a threaded end portion of the pivot bolt **130**.

The second bearing **146** can be of any suitable type or construction and made of any suitable material. In a preferred embodiment, the second bearing **146** is a steel needle thrust bearing having an outer diameter of about 2 3/16 inches and an inner diameter of about 1 1/2 inches. The bearings **140** and **146** function to provide smooth rotation of the pivot member **14**. In alternative embodiments, other means may be used to provide minimal friction between the arm **14** and the base **12**, such as ball bearings, oil impregnated bronze plain bearings, flexures (flexible structures), or the like.

A spring system **50** retained within the housing **44** includes a link **152**, a link bolt **154**, a spring **158**, and a nut plate **156**. The link **152** comprises a resilient metal formed in an L-shape, having a first portion **151** extending substantially perpendicular from a second portion **157** that is substantially canted at its distal end. The link **152** is preferably formed from a sheet of stainless steel, but may be of any suitable material having similar material properties. The first portion **151** comprises a bolt opening **155** centrally displaced along the first portion **151**. The second portion **157** comprises a link pin opening **153** along its canted distal end.

The spring system **50** is coupled to the housing **44** by passing the link bolt **154** through the circular and bolt openings **58** and **155**. In a preferred embodiment, the link bolt **154** is Grade 8 steel having a diameter of about 5/6 inches. A threaded portion of the link bolt **154** engages a threaded hole **160** centrally located within the nut plate **156**. The spring **158** is preferably

a steel heavy-duty compression spring disposed between the nut plate **156** and the first portion **151** of the link **152.**

The spring system **50** is coupled to the pivot member **14** by engaging the link pin **72** with the link opening **153** on the canted end of the link **152.** The spring system **50** functions to control the rotational movement of the pivot member **14.** The link **152** is spring-loaded to resist and control rotational movement of the pivot member **14.** By turning the link bolt **154** clockwise, the threaded portion of the bolt **154** engages the nut plate **156** and compresses the spring **158.** The spring **158** then applies a spring load to the first portion **151** of the link **152,** and further, stiffens the resilient movement or tension in the link **152.** Thus, if the threaded portion the link bolt **154** is fully engaged with the nut plate **156,** the tension in the link **152** will stiffen and the spring system **50** will constrain the pivot member **14** from rotational translation, thereby increasing the turning resistance. Likewise, as the threaded portion the link bolt **154** is disengaged from the nut plate **156,** the pivot member **14** is increasingly free to rotate about the perimeter defined by the semicircular slot **38,** as the spring system **50** would exert minimal spring load on the link pin **72,** thereby loosening the turning resistance.

The frictionless properties of the bearings **140** and **146** allow the pivot member **14** to pivot about the first axis **36** in a plane oblique to the direction of movement when a sufficient side load is applied on the arm **62.** The spring system **50** applies a spring-load on the pivot member **14,** limiting the rotational translation of the pivot member **14.**

In accordance with the preferred embodiments above, the hanger **16** functions as a first resilient or spring-loaded pivoting member. Similarly, the pivot member **14** functions as a second resilient or spring-loaded pivoting member. As would be recognized by one skilled in the art, the mounting of the pivot

member **14** to the baseplate **12** and coupling the pivot member **14** to the spring system **50** can be modified as desired. For example, a urethane bushing, leaf spring or extension spring system with non-indexed centering properties may be used in place of the compression spring system.

In operation, the present invention is ideal for turning a skateboard at a parabolic rate. To perform this function, the improved truck **10** is provided at the front of the skateboard while a conventional truck is provided at the rear. A example of such a conventional truck is provided in U.S. Patent No. 3,945,655, the disclosure of which is incorporated herein by reference. The skateboard is navigated by a rider standing on its deck, by shifting his/her weight from side to side such that it moves in a forward direction. The rider can propel the skateboard forward without removing his/her feet from the deck. Figures 7C and 7D show the serpentine motion of the path of the front truck, which is depicted as **165**, as it weaves over the path of a conventional rear truck, depicted as **160**. It is this difference in frequency between the two sinusoidal paths that is the basis for forward propulsion of the skateboard. In accordance with the present invention, the rear truck becomes a relative point from which the front truck may pivot, and such dynamics acts to pull the board forward, as will be described in further detail later.

The improved maneuvering capabilities of a skateboard incorporating the truck **10** is accomplished by the dual pivoting characteristics of the truck **10**. The resilient bushings **122** and **120** facilitate a first pivoting axis **170** inclined at approximately 30° to 60° relative to the plane of movement. The pivot member **14** provides a second pivoting axis substantially oblique to the plane of movement, and wherein the second pivoting axis is inclined relative the first pivot axis at an angle preferably at about 130° to about 160°, more preferably at 140°.

The dual pivoting truck **10** enable the nose of the skateboard to move in a side-to-side motion.

Referring to Figures 7A, skateboards using a pair of "conventional" trucks **11** turn together at a constant rate along primary sinusoidal path **160.** Both front and rear trucks pivot in one dimension symmetrically and in fixed relation, as shown in Figure 7B. A skateboard according to the preferred embodiments of the present invention, utilizes an improved front truck **10** in combination with a "conventional" rear truck **11.** According to this embodiment, as shown in Figures 7C and 7D, the rear "conventional" truck **11** turns on the primary path **160,** while simultaneously, the front truck **10** turns on a secondary sinusoidal path **165.** As such, the skateboard may trace a variable parabolic path. The front and rear trucks of the skateboard pivot asymmetrically, as the rear truck pivots in one dimension and the front truck pivots in two dimensions, in contrast to the fixed relation provided by a skateboard utilizing a pair of conventional trucks. The asymmetric properties of the improved skateboard enables the front and rear trucks to turn independently, allowing a skateboard rider to create a variable arc of turn with all wheels in contact with the ground, while propelling the skateboard forward.

The angled configuration of the bearing plane **28** (see Figure 5) defines the plane of movement of the nose of the skateboard to-and-fro as an arc illustrated in Figure 6A-C. The arcing lateral movement of the nose provides secondary torquing on the pivot member **14,** in addition to the torque created by weight shift, allowing the rider to turn the skateboard with minimal effort. Additionally, the arcing lateral movement of the nose enables the rider to "carve" the skateboard in a forward serpentine motion as the users twists or shifts his/her weight back and forth. Increasing the angle of the plane **28** increases the amount of secondary torque that the rider can apply to the

pivoting member **14** by shifting his/her weight from one side to the other. As such, the truck of present invention is improved over trucks of the prior art, as it balances the combination of torque upon the arm **14** created by the lateral weight shifting of the user during the side-to-side movement of the skateboard, so that the two movements can work smoothly together. Without the angled bearing plane, lateral weight shift from the center position would bear too little torque upon the rotation of the arm **14**. Conversely, lateral weight shift created upon the arm **14** in a turning position bears too much torque. This imbalance causes jerkiness and loss of turning control.

In use, the truck **10** is attached to the skateboard platform such that the arm **62** of the pivoting member **14** extends rearward. This configuration causes the truck **10** to restore the truck wheels to their center position as the skateboard propels forward. Analogous to a shopping cart, where the wheels are behind the pivot point, the forward movement of the skateboard tends to align the pivoting member **14** with the direction of movement. Thus, the pivoting member **14** acts to automatically center, or self-correct itself, providing stability to the truck **10** as the skateboard travels at higher speeds.

Referring to Figure 5, the spring system **50** functions to provide the truck **10** with additional self-centering capabilities. The spring-loaded link **152** constantly acts upon the link pin **72** to return the truck **10** to its center position. As such, the spring system **50** creates a "non-indexing" center. In other words, the user can push the front of the board from one side to another smoothly past the truck's center position, mimicking the non-biased dynamics of a surfboard. Additionally, the spring system **50** creates a resistance against the arm **14** that correlates to the resistance against the hanger provided by the urethane bushings **120** and **122**. Furthermore, a rider performing an aerial trick, such as an Ollie, can return the board back to the ground

confidently, as the spring system **50** returns the truck **10** firmly back to a conventional orientation upon landing of the board. Thus, the present invention further overcomes the inherent problems of pivoting trucks of the prior art.

A user may adjust the amount of "freedom" of pivotal resistance of the truck **11** via the link bolt **154**. By tightening or loosening the link bolt **154**, the user can vary the tension of the spring **158** on the link **152**, which in turn, limits the rotational movement of the pivot member **14**. Thus, a beginner can fully engage the link bolt **154**, such that the skateboard becomes very stable. A more advanced rider, can loosen the link bolt **154** to provide more pivotal freedom and increased maneuvering. For example, the present invention enables an advanced rider to complete a sharp U-turn on a sidewalk of conventional dimensions.

In alternative embodiments, the base plate of the truck can be altered to any suitable size or shape. An example of a modified embodiment is shown in Figure 8. In other embodiments, the pivot member and hanger may be integrated into a single piece. In this embodiment, the integrated pivot member may include an axle resiliently mounted about an extended portion of the pivot member such that the axle may pivot relative to the pivot member.

The preceding description has been presented with reference to presently preferred embodiments of the invention. Workers skilled in the art and technology to which this invention pertains will appreciate that alterations and changes in the described structure may be practiced without meaningfully departing from the principal, spirit and scope of this invention.

Accordingly, the foregoing description should not be read as pertaining only to the precise structures described and illustrated in the accompanying drawings, but rather should be read consistent with and as support to the following claims which are to have their fullest and fair scope.